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The Ruhr and the RAF

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The following analysis of industrial bombing in the German Ruhr was prepared by the Economic Capabilities Division. The Current Intelligence Staff presents it as the fourteenth in the Current Intelligence Series.

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THE RUHR AND THE RAF

The heavy pounding handed the Ruhr by the RAF this spring gave rise in many quarters to expectations that the attack would be continued with mounting intensity throughout the summer, and to hopes that it might make any subsequent land invasion a mere mopping-up operation. A long period of bad weather has, however, interrupted the RAF's area raids, and their resumption has brought attacks primarily at targets elsewhere in Germany. British bombers may yet return in regular and continuous force to the Ruhr. But it is important to indicate that even if they do, the popular belief that they can inflict decisive damage to the German war machine in the next few months is unsubstantiated.

Such a conclusion is suggested, at least, by a study of the results so far obtained in bombing the Ruhr and by estimates of what might be accomplished by renewing the assault through the third quarter of 1943. These analyses indicate that even if the attack were pressed home during the summer on the scale of May and June, the Ruhr's output would probably be cut only to about two-thirds of last year's production. Moreover, this lost output would have little immediate effect on military capabilities. It might preclude the expansion of offensive operations, but it would still allow the indefinite maintenance of a strong defense.

The Target

"The Ruhr" is a term loosely applied to the densely settled area of heavy industry in and near the valley of the Ruhr River. More arbitrarily defined, this territory extends over about 850 square miles and includes the Rhine on the west, Recklinghausen on the north, Dortmund and environs on the east, and Solingen and Düsseldorf on the south. Certain cities sometimes comprehended in wider definitions of the Ruhr -- notable Krefeld, Cologne, Kassel, and Hamm -- are omitted in the present definition.

From this area came in 1942 one quarter or more of the total Axis output of steel, synthetic rubber, synthetic oil, tungsten carbide, batteries, wire, pipes and tubes, machine tools, heavy machinery, coal and coke; and 30 percent or more of the Axis' armor plate, engine parts, ammunition, artillery, and guns. Qualitatively, much of this production is even more important: it would, for example, be extremely difficult to replace the Ruhr's high-quality steel, its high-test gasoline, or its hard coal and metallurgical coke.

But the significance of the Ruhr lies as much in the high degree of integration which the area has attained as in the contribution of specific industries to the Axis economy. Ruhr producers of end products rely heavily upon raw materials and semi-manufactured products made within the area. Carbon and high-quality steel for the machinery and armament industries of the Ruhr come from local steel plants. The cranes, rolling mills, presses, and pumps of the steel and artillery plants are made, for the most part, within the Ruhr valley.
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The Assumptions

In attempting to foresee the results of the "experiment" during the third quarter of 1943, we shall assume that the RAF will continue to direct the bulk of its night sorties to the Ruhr, maintaining the level of activity reached in recent months. The present pattern involves a rotation of visits among all the major Ruhr cities, with an average bomb-load of about 1,450 tons, fairly equally distributed between high explosive bombs (HE) and incendiary bombs (IB). It will be further assumed that each month will see the equivalent of six such raids -- or about 8,700 tons of bombs -- over the Ruhr as a whole.

The amount of physical and economic damage done by dropping bombs over the Ruhr at the rate of 8,700 tons a month depends to a large extent on the accuracy with which those bombs are directed to vulnerable and important targets. Photo-reconnaissance following past raids in that region has identified between 15 and 30 percent of the bombs dropped in an attack as hits on the built-up area of the target city. These percentages, however, clearly understate the true percentage of hits on a built-up area. The understatement is explained by the following factors: not all HE bombs leave identifiable craters; photographic cover is never complete; and many bombs which miss the target city will hit built-up areas of nearby smaller towns not covered by reconnaissance.

In view of these biases and the discernible trend toward improved navigational accuracy, it seems safe to assume that about 30 percent of the bombs dropped in Ruhr attacks will fall in some built-up area. Thus, 2,610 tons per month would fall in such areas, yielding an average density of nearly 12 tons per square mile per month over those areas. Densities higher than 12 can be expected in and around city centers and large industrial zones like the Krupp works.

The Probable Results

a. Housing. By the end of 1942, about 55,500 dwelling units in the Ruhr had been rendered uninhabitable and about 191,000 persons -- or 4.2 percent of the Ruhr population -- had been "de-housed". The first half of 1943 saw an enormous increase in the weight of RAF raids and in their degree of concentration upon the Ruhr. Thus, in the period between January and June some 167,800 more dwellings are believed to have been rendered uninhabitable. This meant that 16 percent of the Ruhr's original complement of housing had been destroyed all told and an additional 12 percent of the population forced from their homes.

If we assume that as much bomb tonnage will be dropped on the Ruhr in the third quarter of 1943 as in the first half, by October 1 over 25 percent of the Ruhr's dwellings will have been so badly damaged as to be uninhabitable, and some 1,200,000 persons will have been de-housed.

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b. Industrial Buildings. Raids up to the middle of 1943 had inflicted serious damage to 750 acres of the Ruhr's industrial buildings. Continuation of attacks through the third quarter at the May-June rate could be expected to raise this total by 60 percent. By October 1, then, the area of visible damage to industrial buildings would approximate 1,200 acres -- or about one-eighth of all industrial buildings in the Ruhr.

c. Output. Any appraisal of the probable loss of production from bomb damage in the Ruhr must rest as yet on a very slender basis. From analysis, however, of raids on British cities and of the damage visibly inflicted on the Krupp works this spring, certain tentative conclusions are possible. Under the assumption that the Ruhr's industrial areas will, in general, receive their bombs in doses each about half the size of the individual Krupp raids, spaced over a much longer period, it is to be expected that the Ruhr's production will be cut by late summer to about two-thirds of last year's rate of output.

d. Evacuation. Any evacuation or abandonment of Ruhr industries as a result of bomb damage is likely to be highly selective. Maintenance of a particular industry will depend not only upon the importance of its output to the Axis war economy, but also upon its vulnerability to air attack, its inter-connection with other Ruhr industries, the availability of surplus facilities elsewhere, and the transferability of such equipment and manpower as would have to be moved from the Ruhr. (21513)

Most types of industrial facilties found in the Ruhr are not highly susceptible either to blast or fire damage. Those of low vulnerability include plants making armor plate, artillery, pipes and tubes, steel, electric power, coke, and ovens. "Medium vulnerable" are plants making machinery, machine-tools, tanks and trucks, torpedoes and tubes, cables, gas, batteries, engines and parts, electrical engineering products, bearings, synthetic rubber and synthetic oil (by the Fischer-Tropsch process). Plants which have a high vulnerability rating are those making synthetic oil (by hydrogenation), synthetic fibres, and inflammable chemicals.

At least two years would be required to move and put into operation the heavy equipment of the Ruhr steel, machinery, and armament industries. The only industries for which complete evacuation is probable (at least of certain plants) are: engine parts, pipes and tubes, batteries, ovens and furnaces, and parts of the steel industry. These are important enough to the Axis economy to be worth moving, and are also relatively easy to evacuate. Other important industries, such as tungsten carbide, can be rebuilt quite easily and would therefore probably not be shifted.

The fact that the Germans cannot feasibly move the Ruhr's steel industry should not be given an exaggerated importance. In the first place, because of its comparatively low vulnerability, a good proportion of it can doubtless be kept in operation. Secondly, even if the entire Ruhr steel industry were eliminated, and the excess capacity in France and

Belgium were disregarded, the Axis would still have some 31,000,000 tons of effective steel capacity. By reducing industrial requirements for railroad equipment (especially track and structures) buildings, works, and other items, the Germans could get along on an annual steel supply of 35,000,000 tons or less. They could certainly manage on less if military production were reduced, or if industrial consumption were reduced to maintenance requirements alone.

e. Manpower and Transportation. The transfer of Ruhr production would involve at least a corresponding transfer of Ruhr labor, since no adequate industrial manpower reserves are available elsewhere. The resultant strain on transportation and housing facilities would be an important cost of such a move. It should be noted, however, that only a single movement of personnel would be involved, rather than a permanent commitment of transport resources; and that rehousing of many of these workers is a problem that must be faced whether they leave the Ruhr or not.

Such evacuation of industrial plants from the Ruhr as is likely to occur could probably be handled without great difficulty; but this decentralization may impose greater eventual strain on the transport system and introduce congestion at the eastern railroad junctions now used primarily for military traffic to the Eastern front.

f. Effect on Military Operations. The loss of much of the Ruhr output would have no immediate effect on military capabilities. It would take months for the curtailment of coal, coke, steel, and even armament output to make itself

felt. And stocks of heavy military equipment are probably large enough to maintain first-line strength throughout this period of gradual economic decline to a new equilibrium.

On the other hand, if the production of certain Ruhr products were wholly cut off, military activity might be hampered much more quickly. It would take at least a year to move or rebuild the Ruhr's synthetic oil plants, for example, or even to expand existing oil plants with salvaged parts. Before any of these remedies could be applied, the loss of the Ruhr's high-quality output might have created serious difficulties for the Wehrmacht. Again, a drastic drop in the production of top-grade armor plate from the Ruhr would make it -- within a year -- hard for Germany to maintain her first-line strength in military vehicles and stocks of ammunition.

These prospective shortages might prove a limiting factor in plans for both immediate and future operations, and might force the Germans to husband their stocks with care. On the other hand, even if the operating level of the Axis economy as a whole were reduced, a severe restriction of the civilian and industrial sectors and a policy of under-maintaining present capital equipment might enable Germany to recover and sustain its current rate of military output. This might not permit new offensives on the 1941-42 scale; but it would certainly allow the Wehrmacht to put up a stout defense over an indefinite period.

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